

#### An Energy Efficiency Workshop & Exposition

Palm Springs, California

#### Please be courteous to our speakers





Turn off all cell phones

and

Set pagers to vibrate



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Configurations available for 1- 4 Microturbines

Extruded aluminum finned tubes with copper liners and steel headers

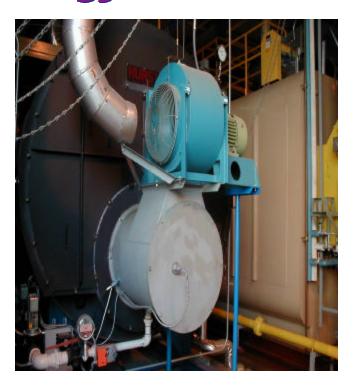
Exhaust diverter valve to dispose excess heat





- (a) 2 30 Kw micro turbines
- (b) Compressor and Heat Exchanger
- (c) Fueled by anaerobic digester gas

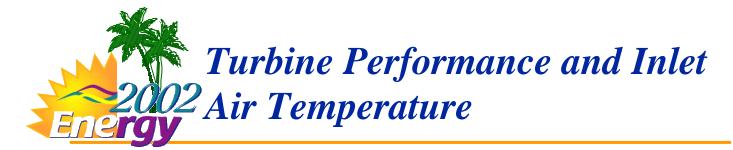




- Relatively constant thermal load
- Long run hours
- 1 MM Btu/hr (400 hp) boiler or greater
- Mission critical application
  - Process application such as food processing

## 2002 Turbine Performance and Output

Net Output (%)	100	90	80	<b>70</b>
Efficiency (%)	27.7	25	22.2	17.4
Fuel Costs (\$/mmBtu)	Cents	per kW	hr Cor	<u>nversion</u>
4.00	5.47	6.07	6.83	7.81
6.00	8.20	9.11	10.25	11.71
8.00	10.93	12.15	13.12	15.62



Air Inlet Temp (F)

Efficiency (%)

<b>59</b>	28.0
68	26.5
77	25.0
86	23.5

Sea Level



	Sensible	S&L adder
Turbines (*)	105,503	
Heat Ex	9,333	-9,333
Compressor	5,610	
Site Prep	2,500	
<b>Electrical Connections</b>	3,000	
Gas Connections	2,000	
Permits	500	
<b>Ducting &amp; Insulatio</b>	754	2,133
Shipping and Handling		
Total	\$ 1538/kW(**)	\$ 1452/kW(**)

<sup>(\*)</sup> Master Turbine - 25,960; 3 Slave Turbines - 77,220; Remote Monitoring - 1,540; Natural Gas Kit - 462; Emergency Stop - 198; and MultiPac Cable - 123

<sup>(\*\*) 30</sup> kW units derated to 28 kW to supply compressor



There are applications where microturbine fuel is available at little or no costs. Some examples include Flare Gas, Coal Bed Methane, Municipal, Industrial, and Agricultural Sewage Treatment Plants, and Landfills. Heat recovery may or may not be practical in these applications.



Application	Sensible	Sens&Lat
Capital Recovery	2.02	1.91
O&M	1.50	1.50
Fuel	8.78	8.78
Heat Rec. Adjustment	_(1.97)	(4.28)
Total	10.33 c/kWhr	7.91 c/kWhr

Assumption: Sea Level, 75 F inlet temp, 100% output, 60 cents per therm, 95% availability, 8% interest and 10 year capital recovery

# Free Fuel Bottom Line

	Sensible	Sens&Lat	w/o Heat Rec
Capital Recovery	2.02	1.91	1.86
O&M	1.50	1.50	1.50
Fuel			
Heat Rec. Adj.	<u>(1.97)</u>	(4.28)	
Total	1.55 c/kWh	-0.87 c/kWh	3.36 c/kWh



### Q and A